Limit analysis approach for the out-of-plane response of walls in masonry buildings

Held by
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Venue: online
Date: 4 hours
Thursday, April 29th 2021, 3:00 p.m. - 5:00 p.m.
Friday, April 30th 2021, 10:00 p.m. - 12:00 p.m.

Abstract

In masonry buildings without a box-type behaviour, such as most existing buildings in historic city centres, local out-of-plane failures especially of peripheral walls can take place, even under low intensities of ground motion. It has been recognized, in particular, that the most recurrent failure modes caused by seismic forces acting orthogonally to the building walls involve simple and complex rocking of parts of masonry, e.g. overturning of masonry façades, with and without parts of sidewalls, and of masonry corners. These kinds of failure generally occur when a monolithic behaviour can be assured for walls so as they can be regarded as rigid blocks.

The objective of this course is to analyse the out-of-plane seismic response of masonry rocking structures by means of limit analysis. This method is very suitable to define the onset and overturning conditions of any wall system considered as a rigid block under seismic actions, according to the force-based and displacement-based assessment procedures, respectively.

In particular, the non-linear static approach provided by the Commentary to the Italian standards (CNTC2018) will be described in its potential to predict the onset and the evolution of motion through incremental kinematic analysis. The stabilising role of friction between interlocked walls and the effects of tie-rods will also be described in order to illustrate the construction of proper pushover curves for unrestrained and restrained wall systems. The seismic verification procedure will be represented by the comparison of the capacity in terms of both forces and displacements with the seismic demand, through the construction of acceleration-displacement response spectra (ADRS). The whole procedure will be exemplified by its application to real case studies.

Agenda

Day #1

Local out-of-plane failures and modelling approaches

- Typical out-of-plane failure modes of existing masonry buildings
- Limit analysis of masonry structures
- Incremental kinematic analysis

Day #2

Displacement-based procedure according to the Italian standards

- Construction of pushover curves for unrestrained and restrained wall systems
- Construction of acceleration-displacement response spectra
- Application of the procedure to real case studies

Prof. Claudia Casapulla's CV

Claudia Casapulla is Associate Professor of Structural Engineering at the University of Napoli Federico II and, since 2002, Staff Member Responsible (SMR) for Laboratories, Courses and Modules of Structural Engineering (Bachelor and Master Levels).

Since 2005, she has been the Principal Investigator of a 1-year national research project and the Responsible of research units supported by the Department of Civil Protection. In 2018 she was awarded the supervision of a 2-year Marie Skłodowska-Curie Individual Fellowship funded within the EU Horizon 2020 framework. She is author of over 120 original research papers and reviewer for more than 35 indexed international journals. Since 2013, she has been serving as an expert peer reviewer for the Italian scientific evaluation (FIRB, VQR, PRIN, PICA, COVID-19, Rita Levi Montalcini projects). She has been ranked the World's Top 2% Scientists 2019, as published by Stanford University on Plos Biology.

Her research interests are mainly focused on the seismic vulnerability of masonry structures and innovative modelling of their collapse behaviour under static and dynamic loadings, from both numerical and experimental points of view. Recent activities are also being devoted to the computational design of 3D masonry assemblage of interlocking blocks, the seismic vulnerability of wall connections in the local mechanisms of masonry buildings, and the analysis and assessment of strengthening interventions with advanced innovative systems.

Le lezioni sono previste svolgersi online. Per richiedere la partecipazione inviare un'email a: casacla@unina.it e per conoscenza a renato.iannelli@unipi.it.